VII. "The Rotation of the Electric Arc." By Alexander Pelham Trotter, B.A. Communicated by Silvanus P. Thompson, F.R.S. Received June 12, 1894.

In the course of experiments made with the view of realising as a practical standard of light, the method of using one square millimetre or other definite area of the crater of the positive carbon of an electric arc,* the author has found that the effective luminosity is not as theory would predict,† either constant or uniform. By the use of a double Rumford photometer, giving alternating fields, as in a Vernon Harcourt photometer, his attention was called to a bright spot at or near the middle of the crater. The use of rotating sectors accidentally revealed that a periodic phenomenon accompanied the appearance of this bright spot, and although it is more marked with a short humming arc, the author believes that it is always present.

An image of the crater was thrown on a screen by a photographic lens; and a disc having 60 arms and 60 openings of 3°, and rotating at from 100 to 400 revolutions per minute, was placed near the screen. Curious stroboscopic images were observed, indicating a continually varying periodicity seldom higher than 450 per second, most frequently about 100, difficult to distinguish below 50 per second, and becoming with a long arc a mere flicker. The period seemed to correspond with the musical hum of the arc, which generally breaks into a hiss at a note a little beyond 450 per second. The hum is audible in a telephone in the circuit, or in shunt to it. The current was taken from the mains of the Kensington and Knightsbridge Electric Light Company, often late at night, after all the dynamos had been shut down. The carbons were, of course, not cored; six kinds were used.

A rotating disc was arranged near the lens, to allow the beam to pass for about 1/1000th of a second, and to be cut off for about 1/100th of a second. It was then found that a bright patch, occupying about one quarter of the crater, appeared to be rapidly revolving. Examination of the shape of this patch showed that it consisted of the bright spot already mentioned, and of a curved appendage which swept round, sometimes changing the direction of its rotation. This appendage seemed to be approximately equivalent to a quadrant sheared concentrically through 90°. Distinct variations in the luminosity of the crater are probably due to the fact that this is only an approximation.

* J. Swinburne and S. P. Thompson, discussion on paper by the author, 'Inst. Electrical Eng.,' vol. 21, pp. 384 and 403.

† Abney and Festing, 'Phil. Trans.,' 1881, p. 890; S. P. Thompson, 'Soc. Arts. Journ.,' vol. 37, p. 332

The *a priori* theory of the constant temperature of the crater is so attractive, that the author is inclined to attribute this phenomenon, not to any actual change of the luminosity of the crater, or to any wandering of the luminous area, as is seen with a long, unsteady arc, but to the refraction of the light by heated vapour. All experiments, such as enclosing the arc in a small chamber of transparent mica, or the use of magnets, or an air blast, have failed to produce any effect. A distortion of the image of the crater while the patch revolves, has been looked for, but nothing distinguishable from changes of luminosity has been seen.

An unexpected difficulty is thus introduced in the use of the arc as a standard of light, and one which may interfere with its use under some circumstances as a steady and continuous source of light. The author is further examining this phenomenon, with the view of ascertaining its nature, and of finding practical conditions under which it is absent or negligible.

VIII. "The Electric Strength of Mixtures of Nitrogen and Hydrogen." By Miss P. G. FAWCETT. Communicated by Professor J. J. THOMSON, F.R.S. Received June 21, 1894.

The experiments described in this paper were undertaken at Professor Thomson's suggestion, and have been carried out with the advantage of his advice and help.

The immediate object of the experiments was to determine the electromotive force required to produce a spark between two flat parallel metal plates in a mixture of hydrogen and nitrogen in different proportions and at different pressures.

The hydrogen used was obtained by electrolysis of water, as it was found that that obtained in the ordinary way from zinc and hydrochloric acid was liable to contain impurities which seriously affected its electric strength.

The two gases were collected over water in a graduated cylindrical gas-holder, and were allowed to stand for some hours to give them time to mix before being put into the apparatus. The mixture was passed through sulphuric acid, and also through cotton wool to remove dust.

The electromotive force was supplied by a battery of storage cells, each of about 2 volts, and was measured simply by counting the number of cells. The strength of the cells was measured by a quadrant electrometer.

At very low pressures it was found that, unless special precautions were taken to prevent the discharge passing anywhere except between